National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

NCAT Test Track Research Update

Pennsylvania Asphalt Pavement Association Annual Conference

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National Center for Asphalt Technology

NCAT

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Turnkey Research





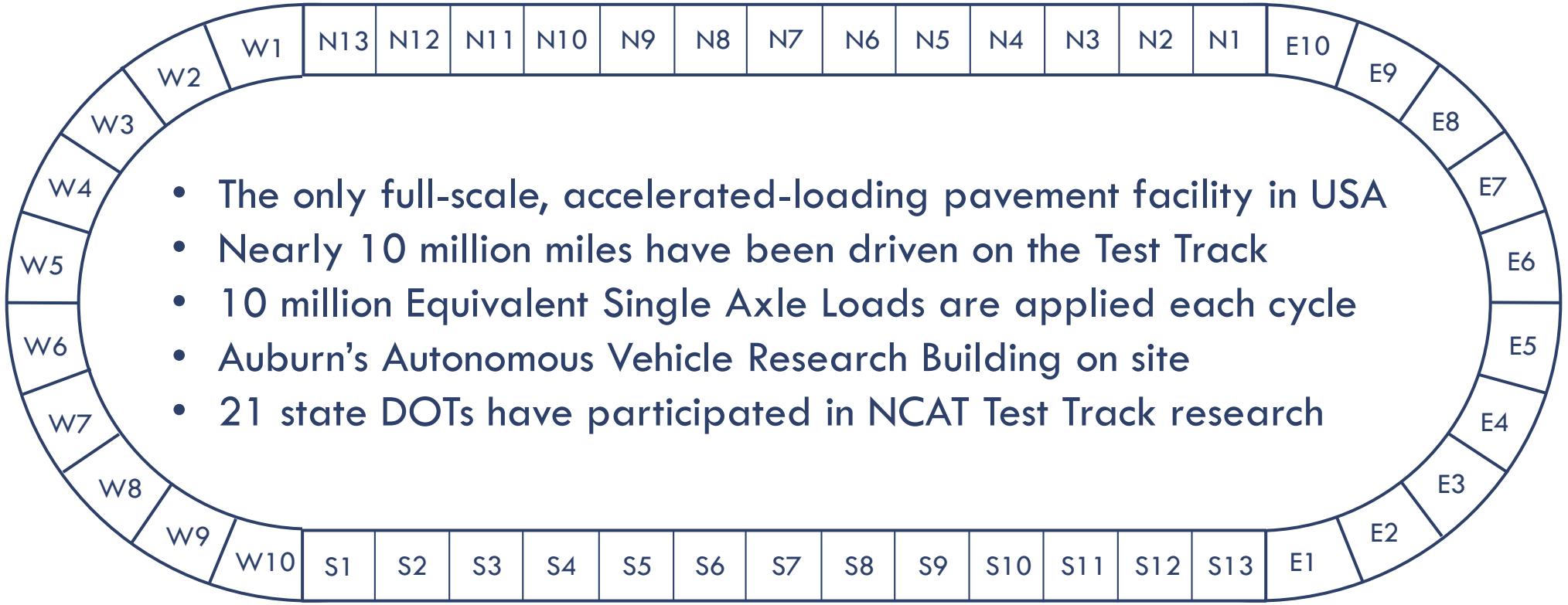


National Center for Asphalt Technology NCAT at Auburn University

NCAT Test Track

- Test sections are evaluated continuously over 3 year cycles
- 2021 began our 8th cycle
- 46 Test Sections, 200 ft. each
- 5 trucks each pulling 3 heavily loaded trailers make 400 laps/day

NCAT Test Track Facts



- The only full-scale, accelerated-loading pavement facility in USA
- Nearly 10 million miles have been driven on the Test Track
- 10 million Equivalent Single Axle Loads are applied each cycle
- Auburn's Autonomous Vehicle Research Building on site
- 21 state DOTs have participated in NCAT Test Track research

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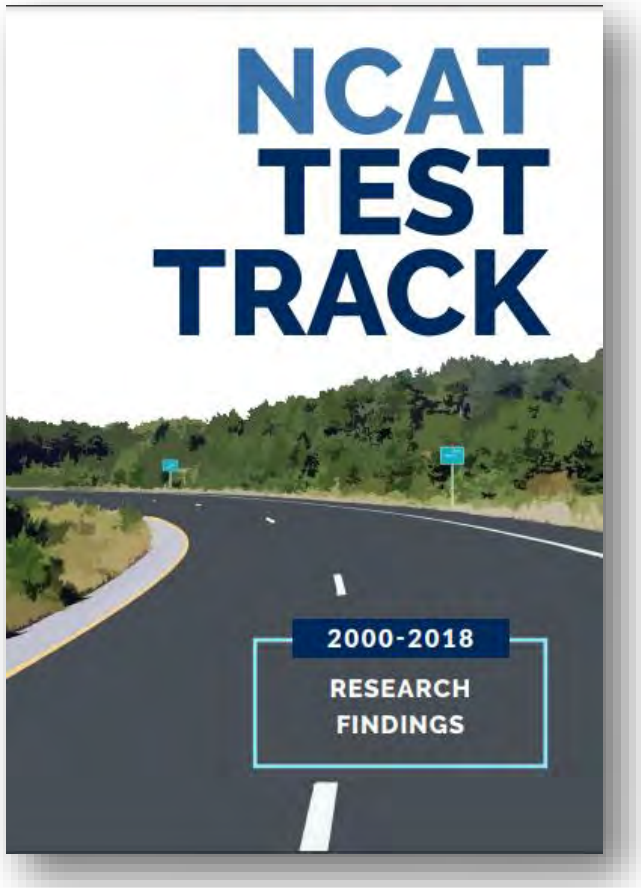
Findings from 20 years of Test Track Research

For more information...visit: www.ncat.us



Since the results of experiments are typically evident in the performance of the sections, the findings are generally easy to interpret. This gives highway agency sponsors confidence to make decisions regarding their specifications, construction practices and pavement design methods that can improve the performance of their roadways. Industry sponsors use the track to publicly and convincingly demonstrate their technology to the pavement engineering community.

Types of Test Track Experiments

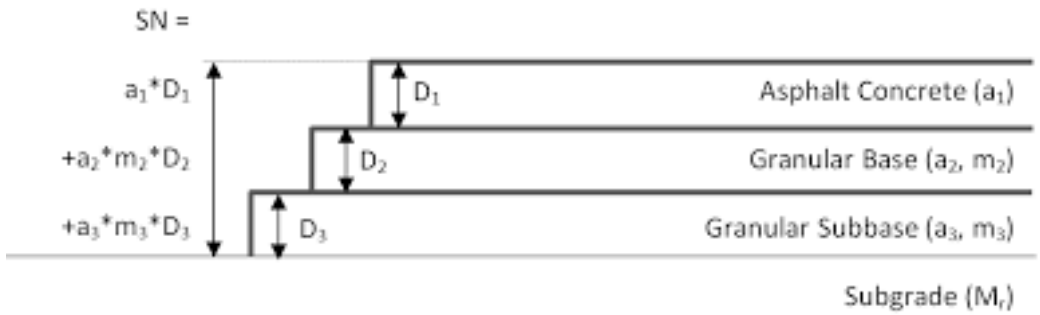
1. Structural Experiments
   - Full-depth reconstruction of cross-section
   - Instrumented with stress & strain sensors and temperature probes.
   - FWD testing throughout experiment

2. Surface-layer Experiments
   - Only upper layer(s) replaced
   - No instrumentation

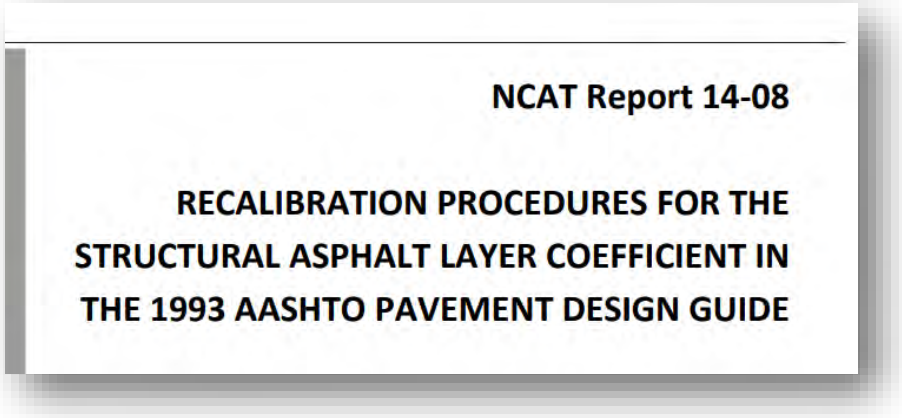
Structural Experiments

Revised Asphalt Layer Coefficient, a_1

- 1993 AASHTO Pavement Design Guide
- Analysis based on…
  - ✓ Lab Modulus
  - ✓ Field deflections and backcalculation
  - ✓ Field Performance

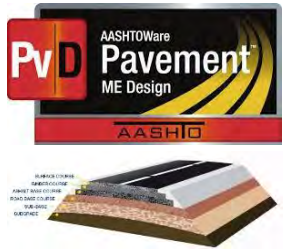


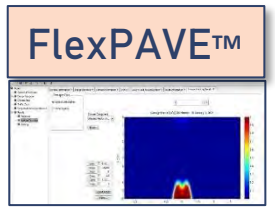
Implemented in Alabama in 2010
Annual Savings between $25 and $50 million


NCAT Report 14-08

RECALIBRATION PROCEDURES FOR THE STRUCTURAL ASPHALT LAYER COEFFICIENT IN THE 1993 AASHTO PAVEMENT DESIGN GUIDE

Mechanistic-Empirical Design Procedures

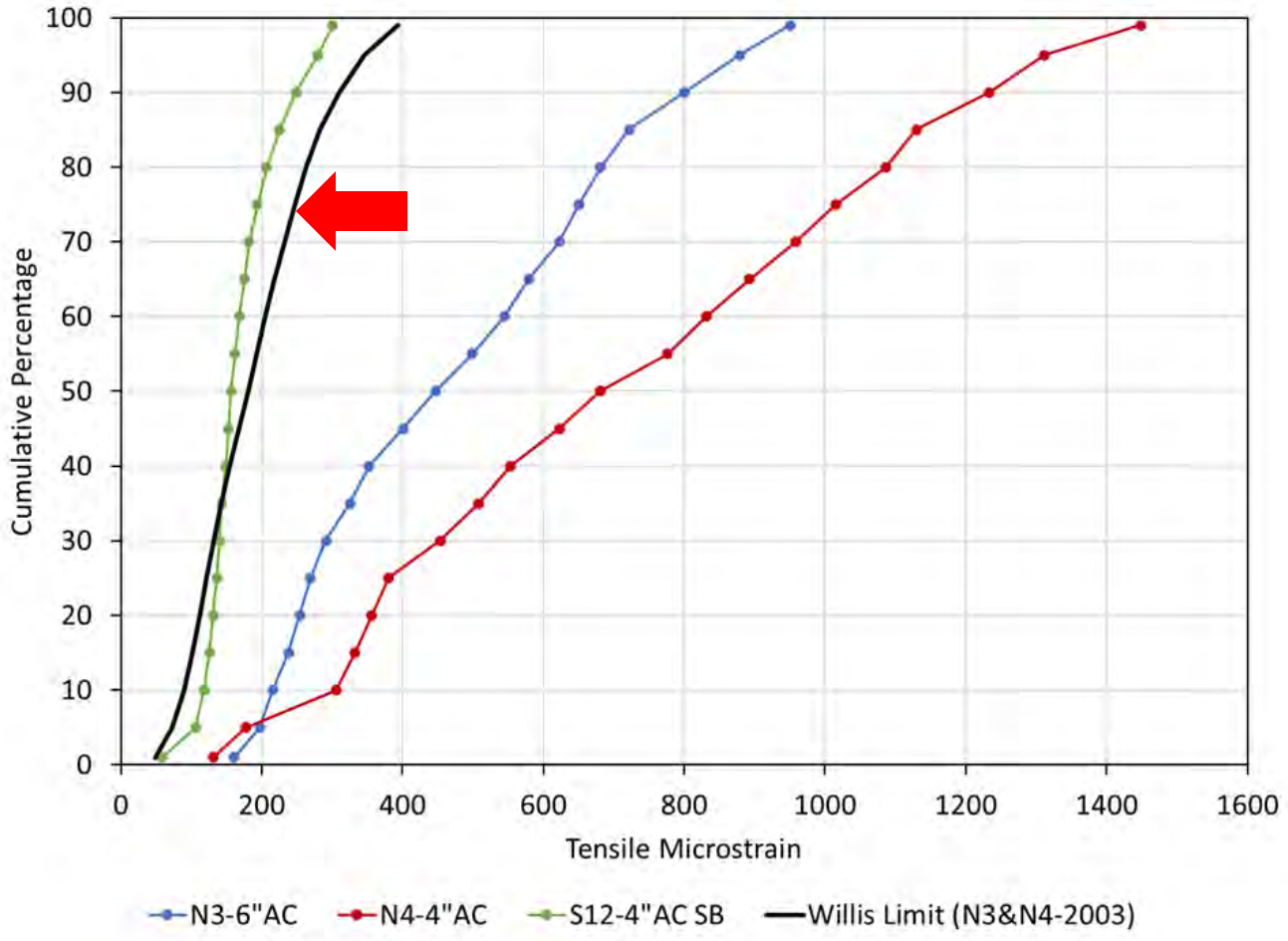


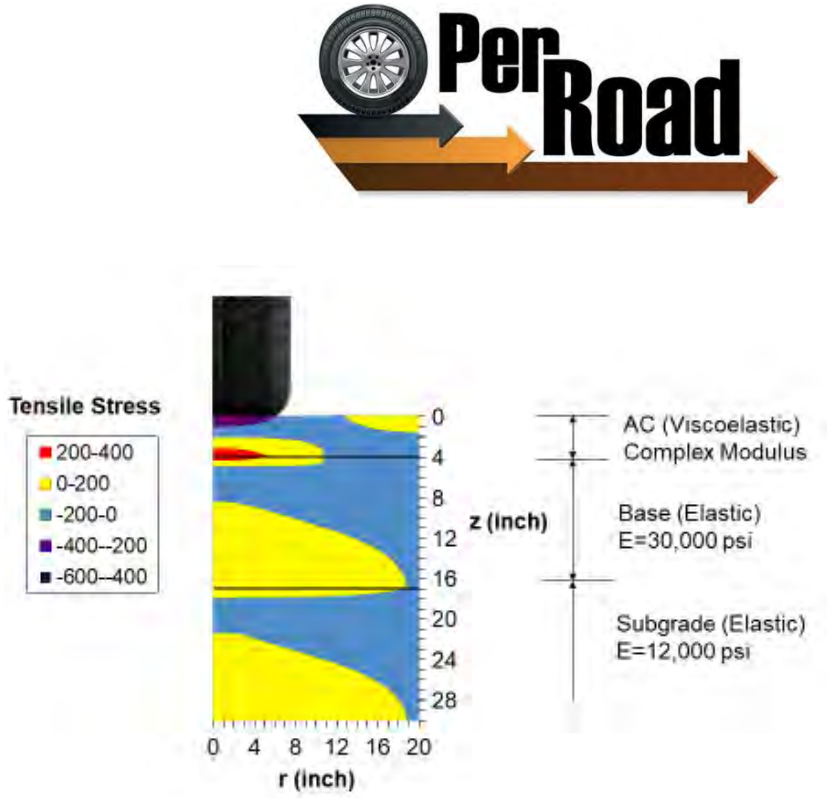


- All of these programs have used NCAT test sections for model calibration.
- MEPDG over-predicted rutting by 50-100% using default national calibration coefficients.
- MEPDG fatigue prediction was poor even after adjusting coefficients.
- Several non-traditional asphalt mixtures and other materials have been validated.

NCAT Test Track

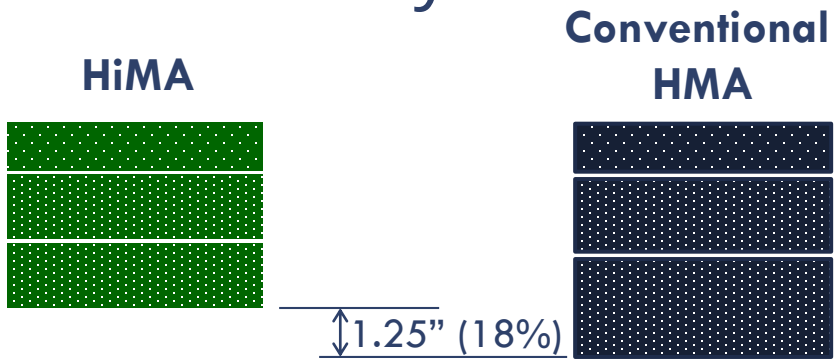
Perpetual Pavement Strain Distributions





Highly Modified HMA Structural Assessment

- 5.75 inches vs 7 inches
- Same mix designs in surface, intermediate, and base layers



- Control section: 10% of lane area fatigue cracking
- HiMA section: 6% of lane area top-down cracking

Cold Central Plant Recycling

Other Structural Experiments

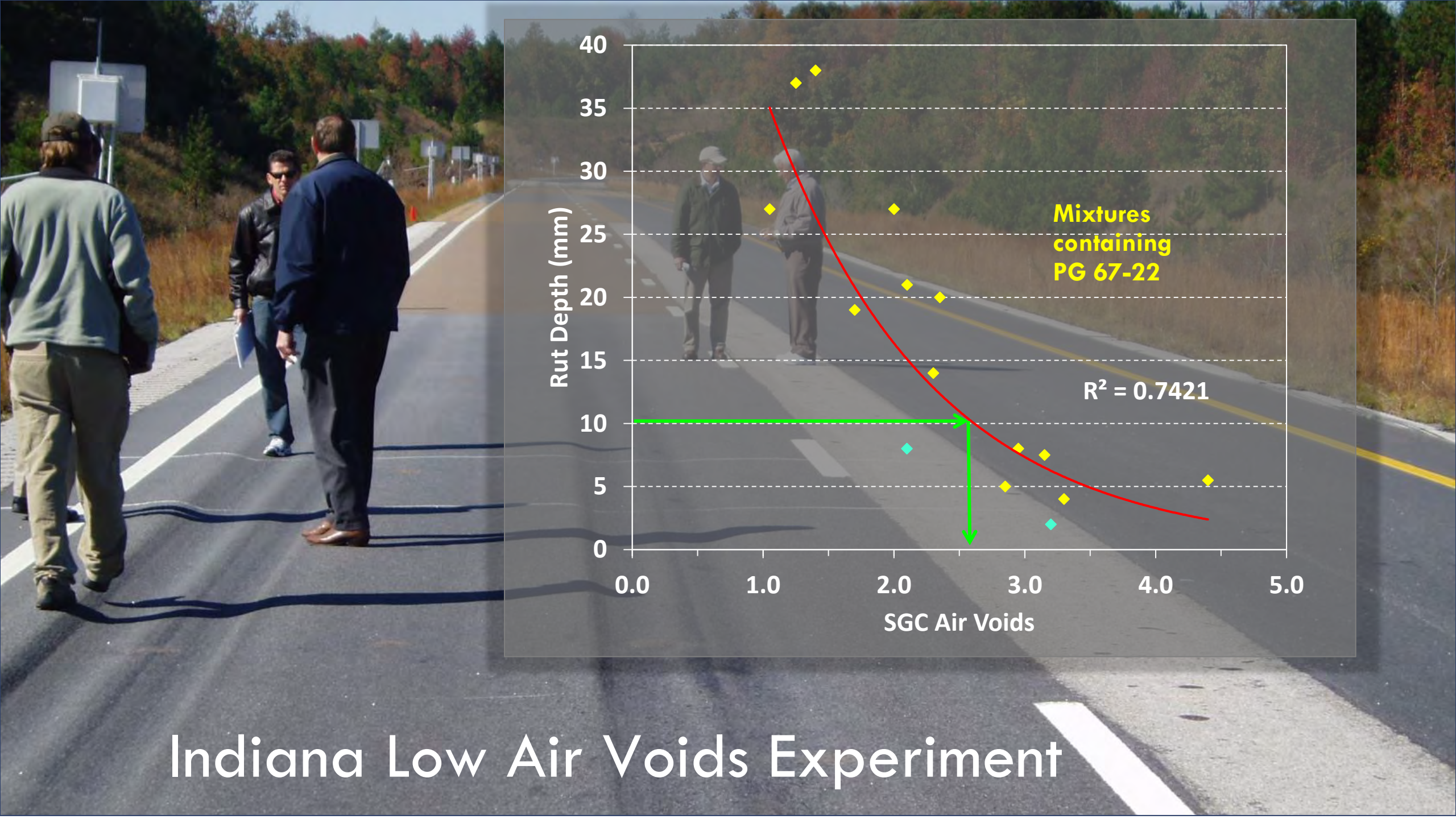
Cement and lime stabilized layers

Thick, Single-Lift Reconstruction

Surface Mix Experiments

Refinements to Mix Design Specifications

- Fine and coarse Superpave mixes perform similarly regardless of aggregate type
- PG 76 vs PG 67 - reduces rutting approximately 50%
- Dense-graded as rut resistant as SMA, but SMA is more durable
- Lowering N_{design} is OK
- 50% RAP mixes perform equal to virgin mixtures in all layers



Indiana Low Air Voids Experiment

Aggregate Specifications

- Elimination of the Restricted Zone
- Evaluation of marginal aggregate
- Gravel suitability in SMA & OGFC
- Higher F&E content for SMA & OGFC
- Maximum limestone content for friction

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Cracking Group Experiment

Which Tests Correlate to Field the Best?

Energy Ratio

SCB-LA

I-FIT

OT-TX

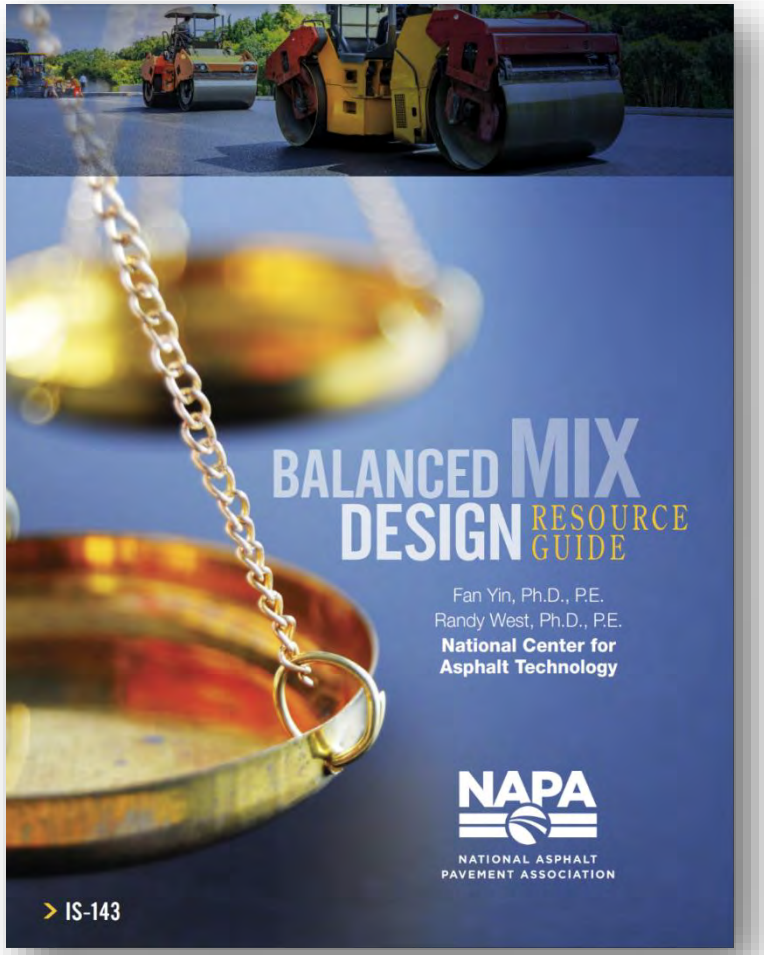
OT-NCAT

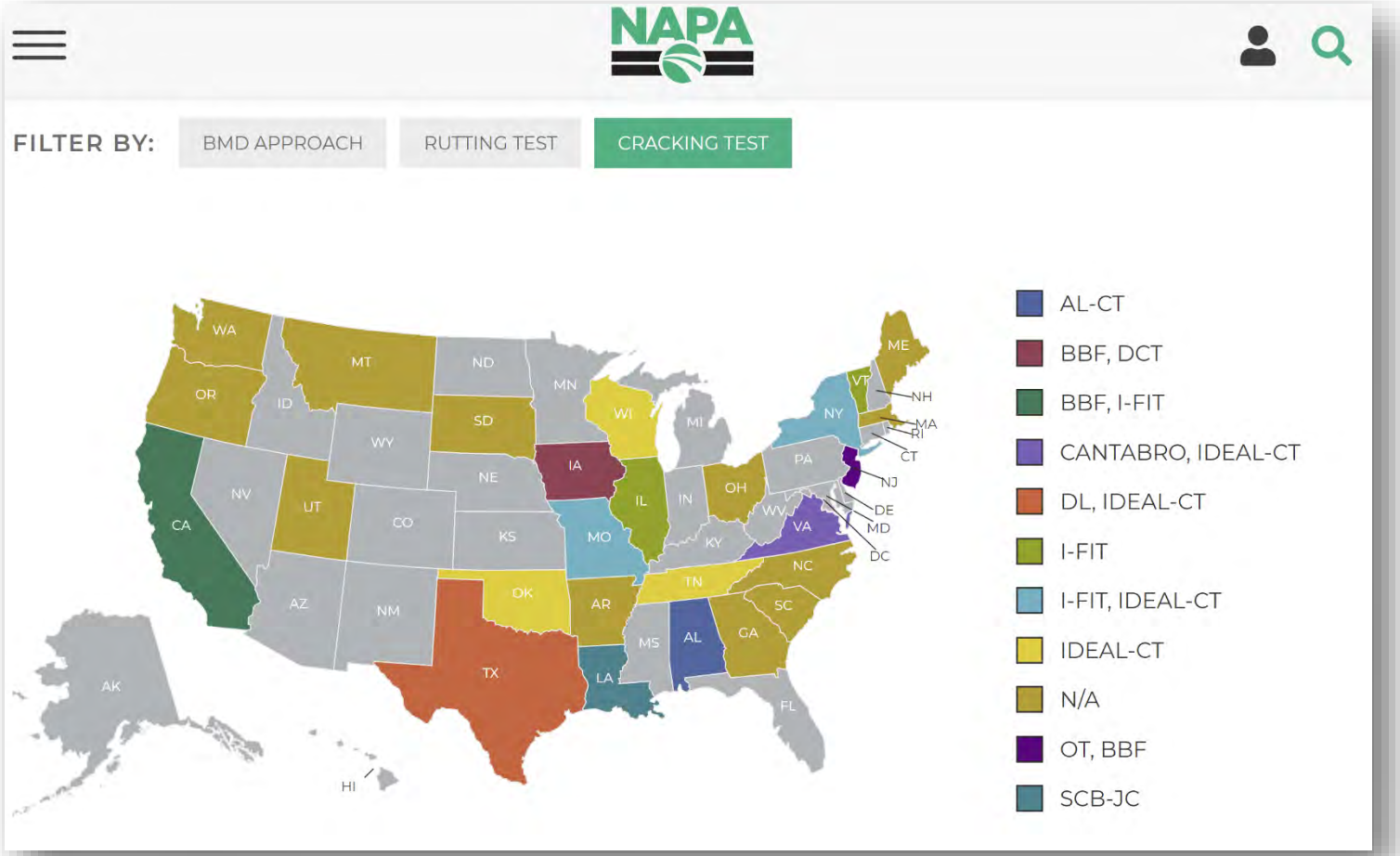
IDEAL-CT

AMPT Cyclic Fatigue

Balanced Mix Design

- Comparison of BMD vs. Superpave
- Preliminary validation of BMD criteria
- Evaluation of innovative additives for improving mix performance and increasing sustainability
- Combining BMD and friction assessment for surface layers





BMD Resources

Scan this code or visit aub.ie/bmd for useful resources related to balanced mix design

The Bucket Brigade

Overview of the NCAT & MnROAD Additive Group Experiment

Additive Group Experiment

- A new experiment to comprehensively evaluate sustainable and resilient pavement technologies
- Continuation of the partnership between NCAT and MnROAD to address national needs

NCAT Test Track

MnROAD

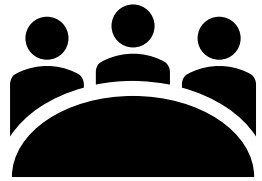
NCAT Additive Group Sponsors

Overall Additive Group Plan

State DOTs commit to sponsoring the AG experiment

NCAT conducts Phase I lab study to evaluate potential additive products

NCAT shares Phase I results with state DOTs



State DOTs select additives for the AG experiment

Construct AG test sections on Test Track

Construct AG test sections on MnROAD

Phase 1 Additive Technologies

Recycled Tire Rubber

EVONIK Leading Beyond Chemistry

entech

LT Lehigh TECHNOLOGIES

Liberty TIRE RECYCLING

U.S. Polyco™ Adhering To Quality

Recycled Plastics

DOW®

necoTECH

GREENMANTRA® TECHNOLOGIES

NVI NEW VILLAGE INITIATIVE

Fibers

FORTA® ASPHALT FIBER

SURFACE TECH

ACE XP POLYMER FIBER

Superior Asphalt Performance

Phase 2 Additive Technologies

Recycled Tire Rubber

entech

wet process

Liberty TIRE RECYCLING

dry process

Recycled Plastics

DOW®

wet process

Brand X LDPE rich

dry process

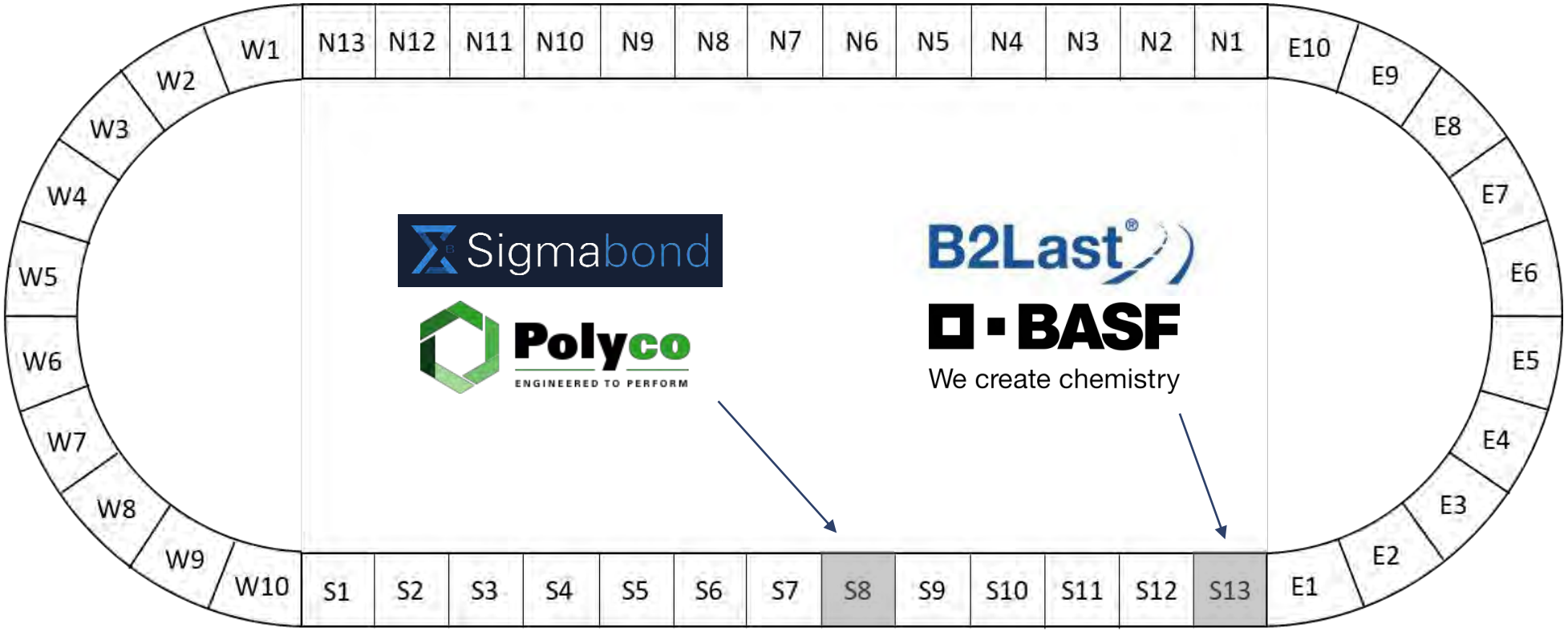
Fibers

SURFACE TECH

ACE XP POLYMER FIBER

Superior Asphalt Performance

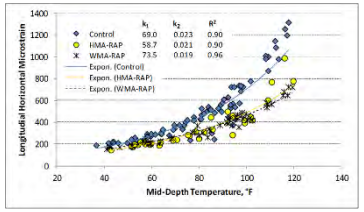
Complementary Sections



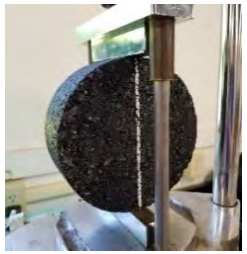
Additive Group Experimental Scope

Performance Data

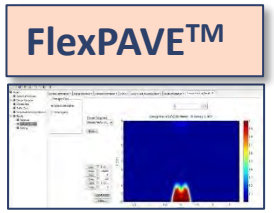
Structural Response



Materials Characterization



Pavement Design



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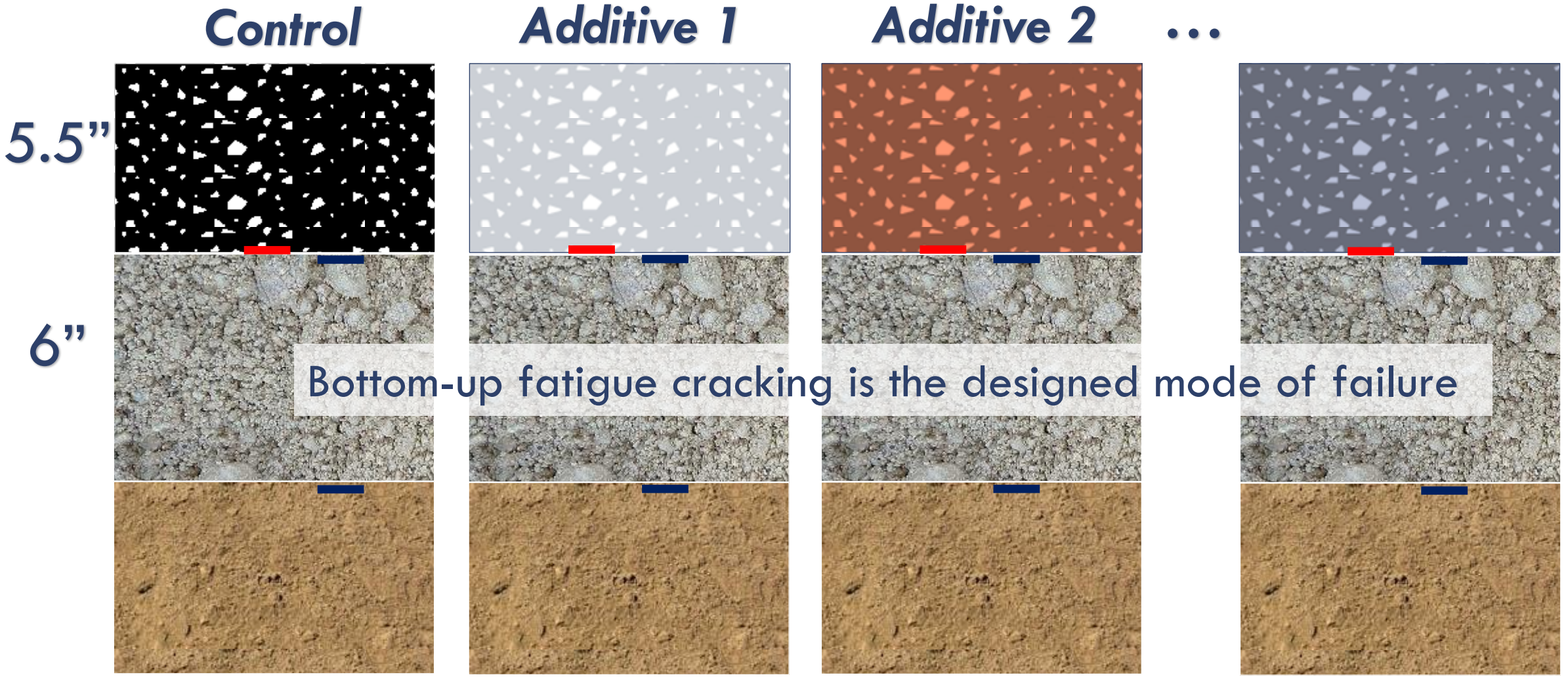
2021 (Eighth) Research Cycle

NCAT Track

NCAT Additive Group Experiment Design



Build & Evaluate AG Test Sections

N1 – Entech wet process GTR

N2 – Liberty SmartMix

N5 – ACE Fibers







S6 generic “LDPE rich” dry plastic







S7 Dow wet plastic




S13 B2Last



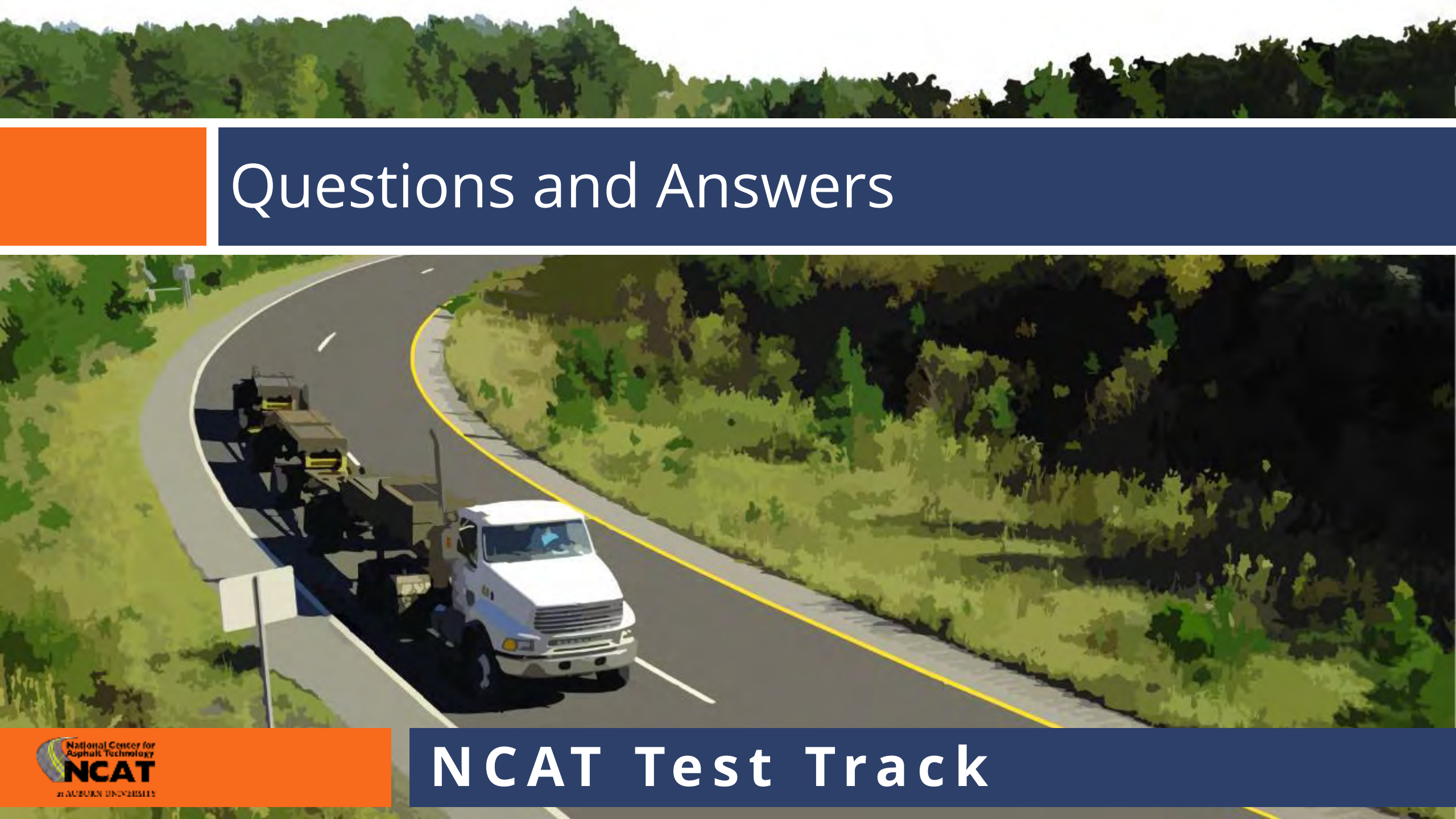





Construction QA Results

	Target	Control	Dry rubber	Wet rubber	Dry plastic	Wet plastic	Fibers
Section		N7	N1	N2	S5	S6	N5
P_b (%)	5.6	5.7	5.6*	5.8	5.8	5.7	5.5
$P_{2.36}$	41	41	45	42	43	42	40
$P_{0.075}$	4.3	4.0	4.3	4.1	3.8	4.0	3.8
Hot Comp. CT_{Index}		101	64	41	40	74	94
Hot Comp. RT_{Index}		85	91	128	144.3	83	98
In-Place Density	> 93.0	95.9	93.7	94.1	93.5	93.9	94.2

Questions and Answers



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